SEEDS

Working Paper Four:

Data Service Provider Model,

Model Parameters

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Outline

1 Introduction

This working paper is the fourth of a set of papers that describes the SEEDS (Strategic Evolution of Earth Science Enterprise Data Systems) Levels of Service (LOS) / Cost Estimation (LOS/CE) study. The study goal is to develop a cost estimation model and coupled requirements and levels of services to support the SEEDS Formulation team in estimating the life cycle costs of future ESE data service providers and supporting systems, where 'data service provider' is used as a generic term for any data/information related activity. The set of working papers is intended to serve as a vehicle for coordinating work on the project, obtaining feedback and guidance from ESDIS SOO and the user community, and as embryos of reports that will be produced as the task proceeds.

As working papers, each version of each working paper that appears represents a snapshot in time, with the work in various stages of completion. As work progresses the content (and sometimes the organization) of the working papers will change reflecting progress made, responses to feedback and guidance received, etc.

This fourth working paper of the set will define and describe the parameters of the general data service provider reference model developed for the LOS/CE study and their relationship with the model's requirements / levels of service. The paper reflects results of the February, 2002, SEEDS Community Workshop. The parameter list and definitions can be expected to undergo considerable evolution as work on developing the model and building the comparables database proceeds over the life of the project.

Section 2 describes the Data Service Provider Reference Model and shows how the requirements / levels of service and model parameters are integral components of the model, organized around the model's functional areas. Section 3 presents the model parameters organized by functional area. Section 4 presents a mapping of the model parameters and the requirements / levels of service.

1.1 Data Service Provider Reference Model Parameters

This section describes the Data Service Provider Reference Model, a functional model of a generic data service provider.

The reference model has three integrated components:

1) A set of 'functional areas' (see Working Paper 3, "Data Service Provider Reference Model - Functional Areas") that collectively comprise the full range of functions that a generic data service provider might perform and the areas of cost that must be considered by the cost estimation by analogy model.

2) A set of requirements and levels of service for each functional area (see Working Paper 5, "Data Service Provider Reference Model - Requirements / Levels of Service").

3) A set of parameters (defined below) for each functional area that constitute a quantitative description of the workload, staff effort, and any other factors that contribute to cost for that area, additional 'roll-up' parameters that sum items such as staff effort across the functional areas, and other parameters like labor rates that are required for cost estimation.

These three aspects of the model are closely coupled to ensure the internal consistency of the model. The set of functional areas is the underpinning; both the model parameters and requirements / levels of service are organized according to the functional areas. The requirements / levels of service and the model parameters are coupled in that the definitions of the requirements / levels of service embody model parameters. This integration of the three components of the model is intended to ensure that estimated costs are driven by and traceable to requirements to the fullest extent possible.

The scope of the reference model parameters spans implementation and operations, year by year over the specified lifecycle of the data service provider, and include cost elements as well as workload factors and high level system configuration information.

The implementation and operations parameters will be broken down into outputs to be provided by the model, internal (derived) parameters used by the model, and inputs required by the model.

The cost estimation relationships to be used by the model will be derived from information describing actual date centers or other data service providers comparable to future ESE data service providers. Raw information received from the data service providers will be mapped to the standard reference model parameter set to build the model's comparables database, so that the database will contain an internally consistent set of parameters.

The comparables database will be used to derive the cost estimation relationships that allow estimation of the outputs given the inputs for independent cases (i.e. testing against independent data for an actual data service provider and eventual use of the model to estimate the costs for a putative new ESE data service provider).

1.2 Reference Model Parameters and Requirements / Levels of Service

As noted, the general data service provider reference model includes a general requirements template, a statement of requirements / levels of service for a generic data service provider, in which the requirements / levels of service are defined for all of the functional areas included in the model.

The requirements / levels of service are a template in that they contain placeholders for quantitative parameters that will be defined for a specific instance of a data service provider. For example, a requirement in the template might be that "the data service provider shall provide an archive capacity of [number TB]". A data service provider of a type that would include providing an archive would have that item in its template. If the mission of the data service provider required that it archive certain data streams and generated products that would accumulate to a total volume of 100 TB, then that value would be inserted into the template, with the result being a specific requirement for that data service provider (i.e., "the data service provider shall provide an archive capacity of 100 TB") that could then be used in the process of generating a cost estimate for the data service provider.

The requirements / levels of service template contains reference model parameters, or place-holders for parameters that must be supplied by the user of the cost estimation tool that is built on the reference model. For example, quantities that are defined in the levels of service associated with a requirement are model parameters whose values are given - the user selects the one applicable for his or her specific case. As a second example, the ingest requirement contains placeholders for the numbers of product types, instances of each type, volume, etc., to be ingested. These are all model parameters, which the user provides as input when using the cost estimation tool. Other parameters are not contained either directly or as place holders in the requirements / levels of service. These include control parameters such as an annual inflation rate to be assumed, which must be specified by the cost estimation tool user, or parameter that are the cost estimation tool's output, such as ingest operator FTE, which would be computed by the model based on ingest workload parameters provided by the user and a cost estimating relationship, or internal parameters that are intermediate steps between the inputs and the outputs.

Section 2 below defines and describes the reference model parameters.

Section 3 presents a mapping of the Data reference model parameters defined in Section 2 to the requirements / levels of service. The intent is to show which parameters fall within the scope of each requirement, and to ensure that each requirement / levels of service that should have one or more parameters associated with it actually does. Second and third level derived parameters (i.e. parameters internal to the model) are not shown.

2 Data Service Provider Reference Model Parameter Definitions

This section presents the definitions of the parameters used by the reference model.

2.1 Introduction

This section introduces the description and definition of reference model parameters that follows in sections 2.2, 2.3, and 2.4.

The reference model parameters are a standard set of parameters that includes some that cover a data service provider as a whole and some that are mapped to the model's functional areas as they apply (i.e., not all parameters are applicable to all functional areas).

The scope of the parameters spans implementation and operations, year by year over the specified lifecycle of the data service provider, and include cost elements as well as workload factors and high level system configuration information.

The implementation and operations parameters will be broken down into outputs to be provided by the model, internal (derived) parameters used by the model, and inputs required by the model.

The cost estimation relationships to be used by the model will be derived from information describing actual date centers comparable to future ESE data service providers. As was done for the Best Practices / Benchmark Study, raw information received from the data service providers will be mapped to the standard reference model parameter set to build the model's database, so that the model's database will contain the same set of output, input, and derived internal parameters covering implementation and operation as will be used for cost estimation. This is necessary, since the model database will be used to derive the cost estimation relationships that allow estimation of the outputs given the inputs for independent cases (i.e. testing against independent data for an actual data service provider and use of the model to estimate the costs for a putative new ESE data service provider).

Implementation includes capital and staff costs associated with developing, implementing, integrating and testing the data service provider's data and information system, and facility start-up / preparation costs. Implementation is assumed to be spread over a specified number of years. Implementation can overlap the start of operations. Implementation can also recur during the operating period, e.g. allowing for 'technology refresh'.

Operation includes hardware maintenance, sustaining engineering, operations staff, supplies (e.g. storage and archive media), recurring facility costs, etc.

The parameters are defined in Section 2.2 grouped by the reference model's functional areas (see White Paper 3, "Data Service Provider Reference Model - Functional Areas". Within each functional area group, the parameters are sorted into internal derived parameters used by the model, input parameters that must be provided by a user of the cost estimation tool, and output parameters, i.e. required outputs from the cost estimation tool.

Section 2.3 contains a list of the cost estimation model output parameters, and Section 2.4 contains a list of the user input parameters required to run the cost estimation model. Both lists are drawn from the parameters defined in Section 2.2.

2.2 Reference Model Parameter Definitions

This section contains a master list of the data service provider reference model parameters and their definitions. The list is grouped by the functional areas described in Section 4.1, followed by facility / infrastructure parameters and data service provider level parameters (some of which are roll-ups from the preceding functional areas). Within each functional area, the parameters will be sorted between internally

computed parameters, parameters provided as user input when executing the cost estimation model, and cost estimation model output parameters.

Information included about each parameter is:

a. Parameter Name;

b. Parameter Definition;

c. Reference to Requirements / Levels of Service (provided in Working Paper 5, "Data Service Provider Reference Model - Requirements / Levels of Service"). The reference will be the number, in brackets, of the sub-section within Working Paper 5 that contains the requirement.

2.2.1 Ingest

These parameters describe or relate to the ingest of data and products into the data service provider from external sources / providers.

2.2.1.1 Internal Computed Parameters

1. **Total Ingest FTE.** The total estimated annual FTE (Full Time Equivalent) effort for the Ingest functional area, including any effort in addition to actual operational effort.
2. **Ingest Management FTE.** Includes direct management associated with the Ingest functional area. Computed from technical and operations staffing.
3. **Ingest Technical FTE.** Includes ingest technical staff exclusive of direct operations staff.
4. **Ingest Ops FTE**. The estimated annual FTE effort for direct operational activity (e.g. computer operators, ingest technicians).
5. **Ingest Volume/Yr.** The annual volume of data and/or products that are ingested by the site. {2.1 a}
6. **Ingest Volume/Yr per FTE.** The annual volume divided by the total staff effort for the Ingest functional area.
7. **Ingest Volume/Yr per Ops FTE.** The annual volume divided by the direct operations staff effort for the Ingest functional area.
8. **Product Types Ingested/Yr.** The annual number of different product types ingested (i.e. data streams ingested) from external sources by the site. {2.1 a}
9. **Product Ingest Formats/Yr.** The number of distinct different product or data formats handled by the Ingest functional area. {2.1 a}
10. **Products Ingested/Yr.** The annual number of products ingested from external sources by the site. { 2.1 a}
11. **Products Ingested/Yr per FTE.** The annual products ingested count divided by the total staff effort for the Ingest functional area.
12. **Products Ingested/Yr per Ops FTE**. The annual products ingested count divided by the direct operations staff effort for the Ingest functional area.
13. **Ingest Function LOS.** The overall measure of ingest function level of service (LOS) integrated over product types. Same values as Ingest LOS for Product Type. {2.1 a}

2.2.1.2 User Input Parameters

1. **Ingest Product Type Name.** The name of product or data type. {2.1 a}
2. **External Ingest Interfaces.** The number of distinct external interfaces via which data streams or products are ingested each year.

3. **Ingest Source**. The source or provider of the product or data type. {2.1 a}
4. **Ingest Delivery Means**. The means of delivery from the source to the data service provider (values: 1 - electronic, 2 - media).
5. **Ingest LOS for Product Type.** Levels of service, assigned by product type, associated with the ingest function are: 1) operational (time-critical) ingest with immediate verification of data integrity and quality; 2) routine ingest and verification of data quality and integrity without tight time constraints; 3) ad hoc or intermittent ingest on a non-operational basis with verification of data quality and integrity; 4) ad hoc or intermittent ingest on a non-operational basis. {2.1 a}
6. **Products of Type Ingested Per Day.** The typical number of instances (individual products of the type) ingested per day. {2.1 a}
7. **Volume of Type Ingested Per Day.** The average data volume ingested per day for this data or product type. {2.1 a}
8. **Ingest Product Type Format.** Incoming format for product type. {2.1 a}
9. **Conversion Format for Product Type.** The format into which instances of the product type are converted to on ingest, if applicable. {2.1 a}
10. **Ingest Product Type Retention Period.** The data service provider's planned retention for this data or product type, can be N years after receipt, or indefinite, for use in computing Archive Volume and Archive Products. (Should be included in applicable life cycle data management plan.) {2.1 a, 2.4 a, 2.4 b}

2.2.2 Processing

These parameters describe or relate to the generation of products by the data service provider.

2.2.2.1 Internal Computed Parameters

1. **Total Processing FTE.** The total estimated annual FTE effort for the Processing functional area, including any effort in addition to actual operational effort.
2. **Processing Management FTE.** Includes direct management associated with the Processing functional area. Computed from technical and operations staffing.
3. **Processing Technical FTE.** Includes technical and science staff exclusive of direct operations staff. Includes staff supporting science software integration and test, cross-calibration specialists as applicable. {2.2 e, 2.2 f}
4. **Processing Ops FTE**. The estimated annual FTE effort for direct operational activity (e.g. computer operators, production monitors).
5. **Volume/Yr of New Operational Products.** The annual volume of operational products generated by the site. {2.2 a}
6. **Volume/Yr of New Ad Hoc Non-Operational Products.** The annual volume of ad hoc, non-operational products generated by the site. {2.2 b}
7. **Volume/Yr of New Products Generated.** The total annual volume of new products generated by the site. {2.2 a, 2.2 b}
8. **Volume/Yr of Reprocessed Products Generated.** The annual volume of reprocessed products generated by the site. {2.2 c, 2.2 d}
9. **Processing Volume/Yr.** The annual total volume of new and reprocessed data and/or products that are generated by the site. {2.2 a, 2.2 b, 2.2 c, 2.2 d}

10. **Processing Volume/Yr per FTE.** The annual processing volume divided by the total staff effort for the Processing functional area.
11. **Processing Volume/Yr per Ops FTE.** The annual processing volume divided by the direct operations staff effort for the Processing functional area.
12. **New Operational Products Generated/Yr.** The annual number of new operational products generated per year by the site. {2.2 a}
13. **New Ad Hoc Non-Operational Products Generated /Yr.** The annual number of new ad hoc non-operational products generated per year by the site. {2.2 b}
14. **New Products Generated/Yr.** The total annual number of new products generated per year by the site. {2.2 a, 2.2 b}
15. **Reprocessed Products Generated/Yr.** The annual number of reprocessed products generated per year by the site. {2.2 c, 2.2 d}
16. **Product Types Generated/Yr.** The annual number of different product types generated by the site. { 2.2 a, 2.2 b, 2.2 c, 2.2 d}
17. **Product Generation Formats/Yr.** The number of distinct different product or data formats handled by the Processing functional area.
18. **Products Generated/Yr.** The annual total number of new and reprocessed products generated by the site. {2.2 a, 2.2 b, 2.2 c, 2.2 d}
19. **Products Generated/Yr per FTE.** The annual products generated count divided by the total staff effort for the Processing functional area.
20. **Products Generated/Yr per Ops FTE**. The annual products generated count divided by the direct operations staff effort for the Processing functional area.
21. **Operational Processing LOS.** The overall measure of operational processing level of service integrated over product types. Same values as Operational Processing LOS for Type. {2.2 a}
22. **Non-Operational Processing LOS.** The overall measure of ad hoc, non-operational processing level of service integrated over product types. Same values as Operational Processing LOS for Type. {2.2 b}
23. **Reprocessing Aggregate Capacity LOS.** The measure of overall capacity for reprocessing. Same values as Reprocessing Capacity for Type. {2.2 c}

2.2.2.2 User Input Parameters

1. **Product Type Name.** The name of product type. {2.2 a, 2.2 b, 2.2 c, 2.2 d}
2. **Product Type Software Source.** A flag, for each product type, that indicates whether the algorithm software produced in-house or received from another activity. {2.2 e}
3. **Product Type QA Function.** A flag that indicates whether the quality assurance (QA) is an in-house function or whether another activity involved.
4. **Production Mode for Type.** Indicates whether this product type is produced operationally or on an ad hoc, non-operational basis. {2.2 a, 2.2 b, 2.2 c, 2.2 d}
5. **Operational Production Mode for Type**. Is the operational generation of this product type performed on demand, or on a routine, scheduled basis. {2.2 a}
6. **Products of Type Generated per Day.** The typical number of instances (individual products of the type) generated per day. {2.2 a, 2.2 b, 2.2 c, 2.2 d}

7. **Volume of Type Generated per Day.** The average data volume generated per day for this product type. {2.2 a, 2.2 b, 2.2 c, 2.2 d}
8. **Product Type Format.** The format in which the new products are produced. {2.2 a, 2.2 b}
9. **Generated Product Type Retention Period.** The data service provider's planned period of retention for this product type (i.e. for each new version that is generated), can be N years after production, or indefinite, or by a rule (e.g. delete if reprocessed, or keep N versions). {2.2 a, 2.2 b, 2.4 a}
10. **Reprocessing Capacity for Type.** The data service provider's required reprocessing capacity for this product, as a multiple of the original processing rate. This is the level of service reprocessing of standard products, values: 1 - the capacity for reprocessing shall be 9 times the original processing rate; 2 - 6 times; 3 - 3 times. {2.2 c}
11. **Reprocessing Plan for Type.** The nominal interval in years at which the data service provider would reprocess the instances of the product type (i.e. create new versions of product instances). {2.2. d}
12. **Operational Processing LOS by Type.** Level of service associated with operational processing of a given product type, values: 1 - standard products shall be generated within 2 days of ingest/availability of required inputs, 2 - within 7 days, 3 - within 30 days. {2.2 a}
13. **Non-Operational Processing LOS by Type.** Level of service associated with ad hoc, non-operational processing of a given product type, values: 1 - specific targets for processing adopted on a case by case basis; 2 - general goals for processing; 3 - no goals, purely ad hoc processing. {2.2 b}
14. **Reprocessing LOS by Type.** Level of service associated with reprocessing according to a schedule (see Reprocessing Plan for Type), values: 1 - reprocess according to negotiated schedule; 2 - reprocess to meet general goals of schedule; 3 - reprocess on time available basis to intent of schedule. {2.2 d}
15. **Science Software LOS.** Level of Service associated with acceptance of science algorithm software from users, values: 1 - accept standard (operational), research product generation software, and/or data integration and data mining software; 2 - accept research product generation software, and/or data integration and data mining software, 3 - accept standard (operational) or research product generation software; 4 - accept research product generation software; 5 - accept standard (operational) product generation software. {2.2 e}
16. **Cross-Calibration Flag.** Indicates if data service provider requires technical expertise in producing products from multiple inputs (e.g. a time series from data collected by a series of instruments on successive platforms) requiring cross-calibration, etc. {2.2 f}

2.2.3 Documentation

These parameters describe or relate to the generation, or bringing up to standard, by the data service provider of documentation of data and products, where 'documentation' includes all descriptive information such as catalog metadata as well as user guides, format descriptions, etc.

2.2.3.1 Internal Computed Parameters

1. **Total Documentation FTE.** The total estimated annual FTE effort for the functional area, including any effort in addition to actual operational effort.
2. **Documentation Management FTE.** Includes direct management associated with each functional area. Computed from technical staffing.
3. **Technical FTE.** Includes technical staff working on documentation (including metadata) review, creation, and update.

2.2.3.2 User Input Parameters

1. **Documentation LOS.** Documentation level of service, values: 1- data and product holdings documented to the standard for long term archiving; 2 - documentation ensured to be sufficient for current use; 3 - documentation only as received from product provider. {2.3 a}
2. **User Comment LOS.** Level of service for incorporating user feedback on products into product documentation. Values: 1) data and products routinely updated with user comments; 2 - data and products occasionally updated with user comments; 3 - data and products rarely updated with user products. {2.3 b}
3. **DIF's Delivered/Yr.** A count of the number of Directory Interchange Format (DIF) records provided by the site to the Global Change Master Directory. {2.3 c}

2.2.4 Archive

These parameters describe or relate to the archiving of data and products by the data service provider.

2.2.4.1 Internal Computed Parameters

1. **Total Archive FTE.** The total estimated annual FTE effort for the Archive functional area, including any effort in addition to actual operational effort.
2. **Archive Management FTE.** Includes direct management associated with each functional area. Computed from technical and operations staffing.
3. **Archive Technical FTE.** Includes technical staff exclusive of direct operations staff.
4. **Archive Ops FTE**. The estimated annual FTE effort for direct operational activity (e.g. computer operators).
5. **Archive Insert Volume/Yr.** The annual volume of data and/or products that are inserted into the site's archive. {2.4 a, 2.4 b}
6. **Archive Insert Volume/Yr per FTE.** The annual Archive Insert Volume divided by the total staff effort for the Archive functional area.
7. **Archive Insert Volume/Yr per Ops FTE.** The annual Archive Insert Volume divided by the direct operations staff effort for the Archive functional area.
8. **Product Types Archived/Yr.** The annual number of different product types added to the site's archive. {2.4 a, 2.4 b}
9. **Product Archive Formats/Yr.** The number of distinct different product or data formats handled by the Archive functional area.
10. **Products Archived/Yr.** The annual number of products added to the site's archive. {2.4 a, 2.4 b}
11. **Products Archived/Yr per FTE.** The annual products archived count divided by the total staff effort for the Archive functional area.
12. **Products Archived/Yr per Ops FTE**. The annual products archived count divided by the direct operations staff effort for the Archive functional area.
13. **Primary Archive Volume.** The year by year cumulative total volume of data contained in the site's primary archive. {2.4 a, 2.4 b}
14. **Backup Archive Volume**. The year by year cumulative volume of data contained in the site's backup archive. {2.4 h}
15. **Archive Volume.** The year by year total cumulative volume of data contained in the site's primary and backup archives. The sum of Primary Archive Volume and Backup Archive Volume. {2.4 a, 2.4 b, 2.4 h}

16. **Archive Volume per FTE.** The archive volume divided by the total effort for the archive functional area.
17. **Archive Volume per Ops FTE.** The archive volume divided by the direct operations staff effort for the Archive functional area.
18. **Archive Media Units**. The number of media units (e.g. tapes) required to hold the data contained in the site's archive.

2.2.4.2 User Input Parameters

1. **Archive Media Type**. The archive media type(s) used by the data service provider. [Background];
2. **Archive Media Standard.** The standard that this media type is in compliance with, or none, level of service values: 1 - archive media consistent with best commercial practice; 2 - archive media and system vendor independent; 3 - archive media vendor independent. {2.4 i}
3. **Archive Media Unit Capacity.** The volume of data that can be written to a single unit of the archive media type.
4. **Archive Media Fill Rate.** The average or typical fraction of a single archive media unit of the archive media type that is filled with archived data or products.

Note: Have to allow for multiple archive media types. Items 1, 3 and 4 above are used in conjunction with Archive Volume to project Archive Media Units.

5. **Archive Capacity.** The maximum capacity of the site's primary archive storage, as either indefinite (i.e. a function of the retention plans without an arbitrary limit, or limited by a specified upper bound. This is the archive capacity level of service, values: 1 - archive capacity is cumulative sum of all data ingested plus all products generated, less deletions per retention plans; N - archive capacity is limited to a specified threshold of N (year by year values). {2.4 e}
6. **Archive Backup LOS.** The level of service associated with archive backup by the site, values: 1- full off-site backup, with regular sampling to verify integrity; 2 - partial, [Backup Fraction - % of archive backed up], off-site backup, with sampling; 3 - partial, [Backup Fraction - % of archive backed up], on-site backup with sampling. {2.4 h}
7. **Archive Backup Fraction.** The fraction of the Primary Archive Volume that is to be backed up. {2.4 h}
8. **Archive Backup Plan**. The data service provider's plan for backing up its archive, including the fraction of the primary archive that is backed up - copied to storage media, and whether the backup storage is on-site or off-site. Level of service, values: 1 - full off-site backup, with sampling to verify integrity; 2 - partial backup, off-site, with sampling; 3 - partial backup, on-site, with sampling. {2.4 c, 2.4 h }
9. **Archive Migration Plan.** The plan that the data service provider has to migrate its archive to a new media and/or archive system, including the period in years between migrations and the migration rate. Includes level of service, values: 1 - planned migration; 2 - no planned migration, but ad hoc migration as need is seen to arise. {2.4 j}
10. **Archive Monitoring.** Archive quality monitoring to support preservation; the fraction of the archive that is scanned for media integrity per year. Level of service values: 1 - 10% per year random screening; 2 - 5% per year random screening; 3 - 1% per year random screening. {2.4 c, 2.4 g}
11. **Archive Entry/Exit Screening.** Archive entry and/or exit data quality screening, level of service values: 1- exit and entry screening; 2 - entry screening. {2.4 c, 2.4 f}

2.2.5 Search and Order

These parameters describe or relate to catalog search and order, allowing users to search metadata for, identify, and request products.

2.2.5.1 Internal Computed Parameters

1. **Total Search and Order FTE.** The total estimated annual FTE effort for the Search and Order functional area, including any effort in addition to actual operational effort.
2. **Search and Order Management FTE.** Includes direct management associated with the Search and Order functional area. Computed from technical and operations staffing.
3. **Search and Order Technical FTE.** Includes technical staff exclusive of direct operations staff.
4. **Search and Order Ops FTE**. The estimated annual FTE effort for direct operational activity (e.g. computer operators).
5. **Internal Catalog Size.** Internal catalog search and order function size - number of product instances included in the catalog.

2.2.5.2 User Input Parameters

1. **Search and Order Scope.** A level of service parameter that establishes the scope of the search and order service offered by the site. Values: 1 - public access to all users; 2 - access to the science and applications community; 3 - access to a limited team of scientists. {2.5 a}
2. **Internal Catalog Search Complexity.** The complexity of the search capability offered to the user, a level of service parameter, values: 1 - search for instances of multiple product types that pertain to a specified object or phenomenon; 2 - search for instances of product types by geophysical parameter, time, and space across multiple product types; 3 - search for instances of multiple product types by time and space (coincident search); 4 - search for instances of single product type by time and space; 5 - search for instances of a product type from a list of instances available. {2.5 b}
3. **External Catalog Search and Order.** The type of interface, if any the data service provider provides to an external search and order capability, values: 1 - none, 2 - external user interface client accesses local catalog information, provides user requests to data service provider, 3 - local catalog information provided to external catalog system which provides user requests to data service provider. {2.5 e}
4. **Descriptive Information LOS.** A level of service parameter that establishes the type of descriptive information to be available for product types or instances returned by a search, values: 1 - detailed algorithm and use explanations, references to papers, standard guide and DIF metadata; 2 - references to papers, standard guide and DIF metadata; 3 - standard guide and DIF metadata {2.5 c}
5. **System-System Search.** A flag that indicates the presence (1) or absence (0) of an automated system-system search capability. {2.5 d}

2.2.6 Access and Distribution

These parameters describe or relate to providing access to and/or distribution of products to users, either on an operational basis or in response to user requests (a.k.a. ‘ad hoc’). This includes providing automated ‘system-system’ access.

2.2.6.1 Internal Computed Parameters

1. **Total Access and Distribution FTE.** The total estimated annual FTE effort for the Access and Distribution functional area, including any effort in addition to actual operational effort.
2. **Access and Distribution Management FTE.** Includes direct management associated with the Access and Distribution functional area. Computed from technical and operations staffing.

3. **Access and Distribution Technical FTE.** Includes technical staff exclusive of direct operations staff.
4. **Access and Distribution Ops FTE**. The estimated annual FTE effort for direct operational activity (e.g. computer operators, distribution technicians).
5. **Access and Distribution Volume/Yr.** The annual volume of data and/or products that are distributed by the site.
6. **Distribution Volume/Yr per FTE.** The annual distribution volume divided by the total staff effort for the Distribution functional area.
7. **Distribution Volume/Yr per Ops FTE.** The annual distribution volume divided by the direct operations staff effort for the Distribution functional area.
8. **Product Types Distributed/Yr.** The annual number of different product types distributed by the site.
9. **Product Distribution Formats/Yr.** The annual number of distinct different product or data formats handled by the Distribution functional area. {2.6 b}
10. **Product Types/Yr Distributed Operationally.** The annual number of product types distributed on an operational basis - on a schedule or by rule to specified users.
11. **Product Formats/Yr Operational.** The annual number of different product formats used for products distributed operationally.
12. **Network Products/Yr Operational.** The annual number products distributed operationally by network.
13. **Network Volume/Yr Operational.** The annual volume of data/products distributed operationally by network.
14. **Media Products/Yr Operational**. The annual number products distributed operationally by media.
15. **Media Volume/Yr Operational.** The annual volume of data/products distributed operationally by media.
16. **Product Formats/Yr By Request.** The annual number of different product formats distributed by in response to user request.
17. **Products Distributed/Yr.** The annual number of products distributed by the site.
18. **Products Distributed/Yr per FTE.** The annual products distributed count divided by the total staff effort for the Distribution functional area.
19. **Products Distributed/Yr per Ops FTE**. The annual products distributed count divided by the direct operations staff effort for the Distribution functional area.
20. **Network Distribution Volume/Yr.** The annual volume of data distributed by the site by network, usually by FTP (File Transfer Protocol). {2.6 f}
21. **Network Distribution Products/Yr.** The annual number of products distributed by the site by network. {2.6 f}
22. **Media Distribution Volume/Yr.** The annual volume of data distributed by the site on media. {2.6 g}
23. **Media Distribution Products/Yr.** The annual number of products distributed by the site on media. {2.6 g}
24. **Distribution Media Units/Yr**. The annual number of media units (i.e. the sum of the number of tapes of various sorts, CD-ROMs, DVDs, etc., used for distribution by the site). {2.6 h}
25. **Distribution Media Types/Yr.** The types of distribution media used by the site (CD-ROM, DVD, 8mm tape, etc.). {2.6 h}

26. **Transmigration Products/Yr.** The number of products per year to be migrated to another center. {2.6 i}
27. **Transmigration Volume/Yr.** The volume of data and products to be migrated to another center. {2.6 i}

2.2.6.2 User Input Parameters

1. **Distribution External Interfaces.** The number of distinct external interfaces for distribution, especially for operational distribution.
2. **Access and Distribution Scope.** A level of service parameter that establishes the scope of the distribution service offered by the site. Values: 1 - public access to all users; 2 - access to the science community; 3 - access to a limited team of scientists. {2.6 a}
3. **Access and Distribution Service Modes.** A parameter characterizing the modes of distribution service offered by the site: distribution operationally, by subscription, and/or in response to request. {2.6 d}

In the case of routine, scheduled, or operational delivery/distribution of products, the data service provider provides, including for each product type delivered:

4. **Product Type Name.** Name of product type. {2.6 a}
5. **Distribution Destination**. Distinct destinations of operational distribution for type, add to Distribution External Interfaces Count.
6. **Timeliness.** Timeliness requirement, if any.
7. **Delivery Means.** Means of delivery (electronic or media, use to sort other items to network or media parameters).
8. **Delivery Format.** Delivery format, if converted from local production or archive format. (2.6 b}
9. **Operational Products/Day, Network.** The count of this product type per day delivered operationally by network. {2.6 f}
10. **Operational Products/Day, Media.** The count of this product type per day delivered operationally by media. {2.6 g}
11. **Operational Volume/Day, Network.** The volume per day of this product type delivered operationally by network. {2.6 f}
12. **Operational Volume/Day, Media.** The volume per day of this product type delivered by media. {2.6 g}

Ad hoc, on request delivery or distribution (by network and media) of products the data service provider provides, including:

13. **Users Requesting Products/Yr.** The number of distinct users requesting products per year.
14. **User Product Requests/Yr.** The number of product requests received per year.
15. **By Request Products/Yr., Media.** The number of products provided per year, on media in response to user requests. {2.6 g}
16. **By Request Products/Yr., Network**. The number of products provided per year, electronically by network. {2.6 f}
17. **By Request Volume/Yr, Media.** The volume of products provided per year in response to user requests on media. {2.6 g}

18. **By Request Volume/Yr, Network.** The volume of products provided per year in response to user requests electronically by network. {2.6 f}
19. **Distribution Format.** Alternative distribution formats offered by a data service provider, where a conversion is done prior to delivery from the locally generated or stored format. {2.6 b}
20. **Distribution Media Type.** List of types of distribution media used by the data service provider.
21. **Distribution Media Units/Yr by Type.** The number of units per year of each type of distribution media provided by the data service provider. This can be a forecast capacity for a prospective data service provider. {2.6 h}
22. **Supporting Data Services.** These services include reformatting, subsetting, packaging, etc. Level of service, values: 1 - supporting services available for most archived data and products; 2 - for less than half of archived data and products; 3 - for a few selected data and products only. {2.6 c}
23. **Network Distribution Response Time.** The average time from when a product request is received and when it is made available for network delivery, a level of service parameter, values: 1 - ten seconds for software access; 2 - ten seconds for FTP pull/push (or equivalent); 3 - ten minutes; 4 - twenty four hours. {2.6 f}
24. **Media Distribution Response Time.** The average time from when a product request is received and when it is written to distribution media, packaged, and ready for shipment, a level of service parameter, values: 1 - three days; 2 - one week; 3 - one month. {2.6 g}
25. **Transmigration Start.** Mission year when migration begins of data, products, and documentation to be transferred another data service provider (e.g. Backbone Data Center or Long Term Archive Center) according to site's Life Cycle Data Management Plan (can be at end of mission, or when products are no longer needed by the site for its mission). {2.6 i}

2.2.7 User Support

These parameters describe or relate to user support provided by the data service provider.

2.2.7.1 Internal Computed Parameters

1. **Total User Support FTE.** The total estimated annual FTE effort for the User Support functional area, including any effort in addition to the direct user support effort.
2. **User Support Management FTE.** Includes direct management associated with the User Support functional area. Computed from technical and operations staffing.
3. **User Support Technical FTE.** Includes technical staff exclusive of direct user support staff.
4. **User Support Ops FTE**. The estimated annual FTE effort for direct user support and outreach.
5. **Direct User Support FTE**. The estimated annual FTE effort for direct user support.
6. **User Contacts/Yr per FTE.** The annual number of user contacts divided by the total effort for user support. Applies to User Support functional area.
7. **User Contacts/Yr per Ops FTE.** The annual number of user contacts divided by the FTE effort for direct user support. Applies to User Support functional area.
8. **Outreach FTE.** The estimated annual FTE for outreach effort.

2.2.7.2 User Input Parameters

1. **User Support Staff Expertise Index.** A general measure or index of the expertise of user support provided by the site, a level of service parameter, values: 1 - science expertise, data structures and tools expertise, format detail expertise, holdings and order/delivery options expertise; 2 - data

structures and tools expertise, format detail expertise, holdings and order/delivery options expertise; 3 - format detail expertise, holdings and order/delivery options expertise; 4 - holdings and order/delivery options expertise. {2.7 b}

2. **Users.** The number of distinct users who contact user support staff in the course of a year. {2.7 a}
3. **User Support Staffing Target.** The number of user support staff as a function of the user base size, a level of service parameter, values: 1 - one user support staff member per 100 active users; 2 - one per 500; 3 - one per 1,000. {2.7 a}
4. **Help Desk Hours of Operation.** The hours of operation of a staffed 'help desk' function, a level of service parameter, values: 1 - 7 days/week x 24 hours/day; 2 - five days/week x 12 hours/day; 3 - 5 days/week x 8 hours/day. {2.7 c}
5. **User Contacts/Yr.** A count of all user contacts - emails, phone calls, etc., handled by the site's user support staff.
6. **Outreach Activity.** A measure of outreach activities performed by the data service provider, a level of service parameter, values: 1 - training sessions, expanded booth support at four conferences/year, produce and distribute outreach material; 2 - expanded booth support at four conferences/year, produce and distribute outreach material; 3 - booth support at four conferences/year, produce and distribute outreach material; 4 - produce and distribute outreach material. {2.7 e}

2.2.8 Instrument / Mission Operations

These parameters describe or relate to instrument and, if applicable, mission operations functions performed by the data service provider. Instrument monitoring, command generation, event scheduling, etc., is assumed to be a 24x7 activity.

2.2.8.1 Internal Computed Parameters

1. **Total Instrument FTE.** The total estimated annual FTE effort for the Instrument / Mission Operations functional area, including any effort in addition to actual operational effort.
2. **Instrument Management FTE.** Includes direct management associated with the Instrument / Mission Operations functional area. Computed from technical and operations staffing.
3. **Instrument Technical FTE.** Includes technical staff exclusive of direct operations staff.
4. **Instrument Ops FTE**. The estimated total annual FTE effort for platform and instrument operations.
5. **Platform Operations FTE.** Includes monitoring status and performance of, and generate commands for spacecraft.
6. **Instrument Operations FTE.** Includes monitoring status and performance of, and generate commands for, instrument(s).

2.2.8.2 User Input Parameters

1. **Platforms Monitored.** The number of platforms whose performance, health and safety, etc., are monitored by the data service provider. {2.8 a}

2. **Platform Actions/Yr.** The number of platform commands generated for upload, platform events scheduled, etc., per year. {2.8 a}

3. **Platform Flag.** Indicates whether or not the data service provider uses the services of a platform operator's mission operations system (e.g. provides commands to a NASA or other operator facility for validation and uploading). {2.8 b}

4. **Instruments Monitored.** The number of instruments the data service provider is responsible for monitoring. {2.8 a}

5. **Instrument Actions/Yr.** The number of instrument commands generated for upload, instrument events scheduled, et., per year. {2.8 a}

2.2.9 Sustaining Engineering

These parameters describe or relate to sustaining engineering (i.e. software maintenance and enhancement of operational software) performed by the data service provider.

2.2.9.1 Internal Computed Parameters

1. **Total Sustaining Engineering FTE.** The total estimated annual FTE effort for the Sustaining Engineering functional area, including any effort in addition to actual operational effort.
2. **Sustaining Engineering Management FTE.** Includes direct management associated with the Sustaining Engineering functional area. Computed from technical staffing.
3. **Sustaining Engineering Technical FTE.** Includes technical staff engaged in software maintenance.
4. **SLOC Maintained.** The number of lines of code that are maintained by the site, of custom (site developed rather than COTS) software used to support the functional areas. Includes reused software. Maintenance is assumed to be equivalent to sustaining engineering - enhancement as well as bug fixes. {2.9 a}

2.2.9.2 User Input Parameters

1. **Sustaining Engineering LOS.** Level of service indicated by allowed impact on operations, values: 1 - no or very infrequent interruptions; 2 - occasional interruptions; 3 - interruptions a secondary concern. {2.9 a}

2.2.10 Engineering Support

These parameters describe or relate to engineering support provided by the data service provider.

2.2.10.1 Internal Computed Parameters

1. **Total Engineering Support FTE.** The total estimated annual FTE effort for the Engineering Support functional area, including any effort in addition to actual operational effort.
2. **Engineering Support Management FTE.** Includes direct management associated with the Engineering Support functional area. Computed from technical staffing.
3. **Engineering Support FTE.** Includes engineering and technical effort that is not otherwise called out, e.g. system engineering, network engineering, test engineering, system administration, and database administration.

2.2.10.2 User Input Parameters

1. **Technical LOS.** Technical (system administration, network administration, database administration, security, etc.) level of service indicated by allowed impact on operations, values: 1 - no or very infrequent interruptions; 2 - occasional interruptions; 3 - interruptions a secondary concern. {2.10 a}
2. **Engineering LOS.** Engineering (systems engineering, test engineering, configuration management, etc.) level of service indicated by allowed impact on operations, values: 1 - no or very infrequent interruptions; 2 - occasional interruptions; 3 - interruptions a secondary concern. {2.10 b}

2.2.11 Technical Coordination

These parameters describe or relate to technical coordination performed by the data service provider.

2.2.11.1 Internal Computed Parameters

1. **Total Technical Coordination FTE.** The total estimated annual FTE effort for the Technical Coordination functional area.
2. **Technical Coordination Management FTE.** Includes direct management associated with the Technical Coordination functional area. Computed from technical staffing.
3. **Technical Coordination FTE.** Includes technical staff directly engaged in technical coordination.
4. **Architecture and IT Coordination FTE.** {2.11 a}
5. **Data Stewardship Coordination FTE.** {2.11 b}
6. **Best Practices and Quality Coordination FTE.** {2.11 c}
7. **Standards and Interfaces Coordination FTE.** {2.11 d}
8. **Inter-Provider Coordination FTE**. {2.11 e}
9. **User Support Coordination FTE.** {2.11 f}
10. **Security Coordination FTE.** {2.11 g}
11. **Metrics Coordination FTE.** {2.11 h}

2.2.11.2 User Input Parameters

1. **Architecture and IT Coordination Flag.** Set to 1 if this activity is required, else 0. {2.11 a}
2. **Data Stewardship Coordination Flag.** Set to 1 if this activity is required, else 0. {2.11 b}
3. **Best Practices and Quality Coordination Flag.** Set to 1 if this activity is required, else 0. {2.11 c}
4. **Standards and Interfaces Coordination Flag.** Set to 1 if this activity is required, else 0. {2.11 d}
5. **Inter-Provider Coordination Flag**. Set to 1 if this activity is required, else 0. {2.11 e}
6. **User Support Coordination Flag.** Set to 1 if this activity is required, else 0. {2.11 f}
7. **Security Coordination Flag.** Set to 1 if this activity is required, else 0. {2.11 g}
8. **Metrics Coordination Flag.** Set to 1 if this activity is required, else 0. {2.11 h}
9. **Technical Coordination Travel Budget.** Annual budget for travel associated with technical coordination. {2.11 i}

2.2.12 Implementation

These parameters describe or relate to system implementation performed by the data service provider.

2.2.12.1 Internal Computed Parameters

1. **Total Implementation FTE.** The total annual estimated FTE for the implementation area.
2. **Implementation Management FTE.** Includes direct management associated with implementation.
3. **Software Development FTE.** The total estimated annual FTE for data system software development, integration, and test, if this is computed by functional area. This will be projected from the amount of software to be developed and the implementation period. {2.12 d}
4. **Applications Software Development FTE.** The estimated annual effort for applications software development for user data services, etc., beyond the base data system. {2.12 c}
5. **Implementation Engineering FTE.** The estimated annual effort for engineering support to system development, e.g. system integration and test, configuration management. {2.12 d}

6. **Custom Software, SLOC.** The size of the software required, if this is computed by functional area. This will be projected from mission parameters that size the system needed.

2.2.12.2 User Input Parameters

1. **Software Reuse Fraction.** The amount of software that will be reused from previous projects for base data system development. The precise formulation is TBD; it must allow for rework of reused software, etc.
2. **Applications Software Development LOS.** A level of service parameter that scopes the applications software development (above the base data system) to meet specific user needs, values: 1 - data mining or data integration, custom science product, data manipulation tools; 2 - custom science product, data manipulation tools; 3 - data manipulation tools; 4 - none. {2.12 e}

2.2.12.3 Cost Model Output Parameters

1. **Development Staff, FTE.** The annual FTE for development effort, technical excluding management.
2. **Development Staff Cost.** The annual cost for development staff, using the development staff labor rate.
3. **Hardware Purchase Cost.** The annual cost for data system hardware needed by the data service provider. This will be projected from mission parameters that size the system needed.
4. **COTS Software Purchase / License.** The cost for purchase of COTS software package and/or annual license costs.
5. **Facility Preparation Cost.** All costs associated with preparation of the facility to house the data service provider, and lease, utilities, etc., during the implementation period.
6. **Total Implementation Period FTE.** The annual sum of all implementation period FTE components.
7. **Total Implementation Period Cost.** The annual sum of all implementation period cost elements.

2.2.13 Management

These parameters describe or relate to management, administrative, and related functions performed by the data service provider.

2.2.13.1 Internal Computed Parameters

1. **Total Management FTE.** The total estimated annual FTE effort for the Management functional area.
2. **Center-Level Management FTE.** Includes center level 'front office' management and administration. Computed from overall functional area staffing. {2.13 a}
3. **Functional Area Management FTE.** Includes the sum of the direct management FTE associated with the other functional areas. Computed from functional area management FTE parameters. {2.13 a}
4. **Planning and Coordination FTE.** The effort associated with coordinating with other ESE data service providers and ESE in management areas such as strategic planning, policies, etc. {2.13. b}
5. **Science Coordination FTE.** The effort associated with coordination of science activities, internal and with ESE and other data service providers, peer review, user advisory processes, etc. {2.13.c}
6. **System Engineering Coordination FTE.** The effort associated with internal system engineering coordination (e.g. planning technology refreshes, etc.). {2.13 d}
7. **Data Stewardship Coordination FTE.** The effort associated with internal data stewardship, data administration, data management planning, etc. {2.13 e}

2.2.13.2 User Input Parameters

None.

2.2.14 Facility / Infrastructure

These parameters describe or relate to facility support and infrastructure maintenance performed by the data service provider.

2.2.14.1 Internal Computed Parameters

1. **Total Facility / Infrastructure FTE.** Includes the sum of Facility / Infrastructure elements.
2. **Facility / Infrastructure Management FTE.** Effort for managing Facility / Infrastructure activities.
3. **Logistics Support FTE.** Includes property management, logistics, consumables procurement, facility support, etc., within the data service provider. {2.14 d}
4. **Security FTE.** Includes physical and IT security effort. {2.14 a}

2.2.14.2 User Input Parameters

1. **External Net Connection**. A list of external network connections that the data service provider supports.

2. **Source / Service.** The vendor that is the source of the network connection or provider of the network service.

3. **Bandwidth.** The nominal bandwidth or class of service or capacity of the network connection.

4. **Recurring COTS Software License Cost.** Cost of annual renewal / update of COTS licenses. Placeholder for now.

5. **Facility Area**. The area in square feet required to house the data service provider.
6. **Data System Area.** The area within the facility required to house the data service provider's data system(s).
7. **Backup Archive Facility LOS.** A level of service parameter characterizing the backup archive facility provided by the site, values: 1 - an environmentally controlled and physically secure off-site backup archive facility; 2 - an on-site but separate environmentally controlled and physically secure off-site backup facility; 3 - a backup capability within the data service provider's primary data system(s). {2.14 c}
8. **Internal Support LOS.** The level of service associated with resource planning, logistics, facility management, etc., values: 1 - no or very infrequent interruption of operations; 2 - occasional interruptions of operations; 3 - as needed, with interruption of operations a secondary concern. {2.14 d}

2.2.14.3 Cost Model Output Parameters

1. **Recurring Network / Communications Cost.** The cost associated with network connectivity required by the data service provider.
2. **Recurring COTS Software Cost.** The cost for COTS upgrades or licenses during the operating period.
3. **Hardware Maintenance Cost.** The annual cost of maintaining the system hardware, assumed to be TBD a fraction of the hardware purchase cost.
4. **Supplies Cost.** The annual cost of supplies, including storage and distribution media.
5. **Recurring Facility Cost.** The total annual facility cost, including lease, utilities, etc., during the operating period.

2.2.15 Site Level Parameters

These parameters describe or relate to the data service provider site as a whole. In some cases they are roll-ups of (selected) functional area parameters listed above.

2.2.15.1 Internal Computed Parameters

None

2.2.15.2 User Input Parameters

None

2.2.15.3 Cost Model Output Parameters

1. **Management Staff, FTE.** The annual FTE associated with management and administration, including financial administration, supervision, and other administrative functions. Includes overall data service provider management as well as management associated with individual functional areas.
2. **Management Staff Cost.** The cost for management staff, above, using the management staff labor rate.
3. **Technical Coordination Staff FTE.** The annual FTE associated with supporting SEEDS technical coordination processes, including developing and maintaining common standards and interfaces.
4. **Technical Coordination Staff Cost.** The cost for technical coordination staff, above, using the technical coordination staff labor rate.
5. **Sustaining Engineering FTE.** The annual FTE associated with sustaining engineering, which includes bug fixes and enhancements to custom software.
6. **Sustaining Engineering Staff Cost.** The cost for sustaining engineering staff, using the sustaining engineering staff labor rate.
7. **Engineering Support FTE.** The annual FTE associated with system engineering, system administration, database administration and other general technical support.
8. **Engineering Support Staff Cost.** The cost for engineering support staff, using the engineering support labor rate.
9. **Operations Staff FTE.** The annual FTE for all aspects of data service provider operations, including system operations, user support, etc.
10. **Operations Staff Cost.** The cost for operations staff, using the operations staff labor rate.
11. **Total Operating FTE.** The annual sum of the operating FTE components.
12. **Total Operating Cost.** The annual sum of all operating cost elements.

2.2.16 Control Parameters

These parameters provide control information for execution of the cost estimation model. Some apply across data service providers, rather than to a particular data service provider.

2.2.16.1 Internal Computed Parameters

None

2.2.16.2 User Input Parameters

1. **Annual Inflation Rate.** The annual rate of inflation to be applied to all recurring staff costs, lease costs, or license costs.

2. **Processing Hardware Discount Rate.** The annual rate at which the cost of processing hardware of constant capacity is projected to decline, 50% in 18 months (i.e. capacity per unit cost doubles in 18 months).
3. **Storage Hardware Discount Rate.** The annual rate at which the cost of storage hardware of constant capacity is projected to decline, 50% in 12 months (i.e. capacity per unit cost doubles in 12 months).
4. **Network Capacity Discount Rate.** The annual rate at which the cost of constant network capacity or bandwidth is projected to decline, 50% in 9 months (i.e. capacity per unit cost doubles in 9 months).
5. **COTS Software Discount Rate.** The annual rate at which the cost of COTS software of constant capability is projected to decline. (TBD)
6. **Implementation Period.** The number of mission years over which development costs are spread - implementation is assumed to start with mission year 1.
7. **Management Staff Labor Rate**. The fully loaded labor rate for management and administration.
8. **Technical Coordination Staff Labor Rate.** The fully loaded labor rate for technical coordination.
9. **Development Staff Labor Rate.** The fully loaded labor rate for development staff.
10. **Operations Period.** The number of mission years over which operations costs are spread.
11. **Operations Start.** The mission year during which operations are assumed to start.
12. **Operations Staff Labor Rate.** The fully loaded labor rate for operations staff.
13. **Sustaining Engineering Staff Labor Rate.** The fully loaded labor rate for sustaining engineering.
14. **Engineering Support Labor Rate.** The fully loaded labor rate for engineering support.

2.3 Cost Estimation Model Output Parameters

These parameters, defined in section 2.2 above, are the output that will be produced by the cost estimation model; i.e. they comprise the initial draft of the content of the cost estimate. They are grouped into costs (and support information) for the initial implementation period, followed by costs (and support information) for the operations period.

2.3.1 Initial Implementation Period

1. Management Staff, FTE.
2. Management Staff Cost.
3. Technical Coordination Staff FTE.
4. Technical Coordination Staff Cost.
5. Development Staff, FTE.
6. Development Staff Cost.
7. Hardware Purchase Cost.
8. COTS Software Purchase / License.
9. Facility Preparation Cost.
10. Total Implementation FTE.
11. Total Implementation Cost.

2.3.2 Operations Period

1. Management Staff FTE.
2. Management Staff Cost.
3. Technical Coordination Staff FTE.
4. Technical Coordination Staff Cost.
5. Sustaining Engineering FTE.
6. Sustaining Engineering Cost.
7. Engineering Support FTE.
8. Engineering Support Cost.
9. Operations Staff FTE.
10. Operations Staff Cost.
11. Development Staff FTE.
12. Development Staff Cost.
13. Recurring Network / Communications Cost.
14. Recurring COTS Software Cost.
15. Hardware Purchase Cost.
16. Hardware Maintenance Cost.
17. Supplies Cost.
18. Recurring facility Cost.
19. Total Operating FTE.
20. Total Operating Cost.

2.4 Cost Estimation Model User Input Parameters

These parameters, defined in section 2.2 above, must be provided by the user when executing the cost estimation model.

These parameters apply to both implementation and operations. They include control parameters that apply to the data service provider, such as labor rates and planned implementation and operation periods, and parameters that describe the mission workload planned for the data service provider. These mission parameters drive the sizing of the data service provider, and the sizing drives the estimated costs.

2.4.1 Control Parameters

These are overall control parameters that are required for any data service provider whose costs are to be estimated.

1. Annual Inflation Rate.
2. Hardware Discount Rate.
3. COTS Software Discount Rate.
4. Implementation Period.
5. Management Staff Labor Rate.

6. Technical Coordination Staff Labor Rate.
7. Development Staff Labor Rate.
8. Operations Period.
9. Operations Start.
10. Operations Staff Labor Rate.
11. Sustaining Engineering Staff Labor Rate.
12. Engineering Support Labor Rate.

Others TBD.

2.4.2 Mission Parameters

This set of parameters constitutes a complete description of the mission requirements the data service provider must meet, and thus constitutes the sizing information for the data service provider. These parameters are derived from mission descriptions for data service providers. Mission descriptions from actual data service providers will be used to build the comparables database, and mission descriptions for future data service providers will be a source for cost estimation input parameters.

Mission parameters will be listed by functional area in the sections that follow below. Each section will contain a list of the information that will be collected from data service providers for that area. Some of the information is needed for a background understanding of how the data service provider functions and is more directly related to the requirements and levels of service discussed in Section 5.

2.4.2.1 Ingest

Mission parameters for the ingest function are drawn from a description of the data or product streams the data service provider ingests. The description includes the information listed below for each data or product type.

1. Product Type Name.
2. Ingest External Interfaces.
3. Ingest Source.
4. Ingest Delivery Means.
5. Ingest LOS for Product Type.
6. Products of Type Ingested Per Day.
7. Volume of Type Ingested Per Day.
8. Ingest Product Type Format.
9. Conversion Format for Product Type.
10. Ingest Product Type Retention Period.

2.4.2.2 Processing

Mission parameters for the processing function are drawn from a description of the product streams the data service provider generates. The description includes the information listed below for each data or product type.

1. Product Type Name.
2. Product Type Software Source.
3. Product Type QA Function.

4. Production Mode for Type.
5. Operational Production Mode for Type.
6. Products of Type Generated per Day.
7. Volume of Type Generated per Day.
8. Product Type Format.
9. Generated Product Type Retention Period.
10. Reprocessing Capacity for Type.
11. Reprocessing Plan for Type.
12. Operational Processing LOS by Type.
13. Non-Operational Processing LOS by Type.
14. Reprocessing LOS by Type.
15. Science Software LOS.

2.4.2.3 Documentation

TBD. Mission parameters for the documentation function are drawn from a description of the product streams the data service provider ingests or generates and adds to its archive. The scope of the documentation can be indicated by a) a count of the product types the data service provider handles, since there can be extensive documentation of each product type, and b) a count of the number of product instances the data service provider handles, since there will be documentation associated with each product instance, if only to identify its unique spatial and temporal coverage. Another dimension is the complexity of the documentation, which may be driven by documentation standards that the data service provider uses on its own accord or is required to use.

1. Documentation LOS.
2. User Comment LOS.
3. DIFs Delivered/Yr.

2.4.2.4 Archive

Mission parameters for the processing function are drawn from a description of the product streams the data service provider ingests and generates. Details concerning the retention on the archive of data and products ingested by the data service provider from external sources or generated locally by the data service provider are included in the ingest and processing information described above. The required archive capacity can be projected from that information.

1. Archive Media Type.
2. Archive Media Standard.
3. Archive Media Unit Capacity.
4. Archive Media Fill Rate.
5. Archive Capacity.
6. Archive Backup LOS.
7. Archive Backup Fraction.
8. Archive Backup Plan.

9. Archive Migration Plan.
10. Archive Monitoring.
11. Archive Entry/Exit Screening.

2.4.2.5 Search and Order

Mission parameters for the search and order function are drawn from a description of the catalog search and order services the data service provider provides.

1. Search and Order Scope.
2. Internal Catalog Search Complexity.
3. External Catalog Search and Order.
4. Descriptive Information LOS.
5. System-System Search.

2.4.2.6 Access and Distribution

Mission parameters for the access and distribution function are drawn from a description of the operational and ad hoc access and distribution services the data service provider provides.

1. Distribution External Interfaces.
2. Access and Distribution Scope.
3. Access and Distribution Service Modes.

Routine, scheduled, or operational delivery/distribution of products the data service provider provides, including for each type delivered:

4. Product Type Name.
5. Distribution Destination.
6. Timeliness.
7. Delivery Means.
8. Delivery Format.
9. Operational Products/Day, Network.
10. Operational Products/Day, Media.
11. Operational Volume/Day, Network.
12. Operational Volume/Day, Media.

Ad hoc, on request delivery or distribution of products the data service provider provides, including:

13. Users Requesting Products/Yr.
14. Product Requests Received/Yr.
15. By Request Products/Yr, Media.
16. By Request Products/Yr, Network.
17. By Request Volume/Yr, Media.
18. By Request Volume/Yr, Network.
19. Distribution Format.

20. Distribution Media Type.
21. Distribution Media Units/Yr by Type.
22. Supporting Data Services.
23. Network Distribution Response Time.
24. Media Distribution Response Time.
25. Transmigration Start.

2.4.2.7 User Support

User support services provided by the data service provider, including:

1. User Support Staff Expertise Index.
2. Users.
3. User Support Staffing Target.
4. Help Desk Hours of Operation.
5. User Contacts Per Year.
6. Outreach Activity.

2.4.2.8 Instrument / Mission Operations

Instrument monitoring, command generation, event scheduling, etc., is assumed to be a 24x7 activity.

1. Platforms Monitored.
2. Platform Actions/Yr.
3. Platform Flag.
4. Instruments Monitored.
5. Instrument Actions/Yr.

2.4.2.9 Sustaining Engineering

1. Sustaining Engineering LOS.

2.4.2.10 Engineering Support

1. Technical LOS.
2. Engineering LOS.

2.4.2.11 Technical Coordination

1. Architecture and IT Coordination Flag.
2. Data Stewardship Coordination Flag.
3. Best Practices and Quality Coordination Flag.
4. Standards and Interfaces Coordination Flag.
5. Inter-Provider Coordination Flag.
6. User Support Coordination Flag.
7. Security Coordination Flag.
8. Metrics Coordination Flag.

9. Technical Coordination Travel Budget.

2.4.2.12 Implementation

1. Software Reuse Fraction.
2. Applications Software Development LOS.

2.4.2.13 Management

None.

2.4.2.14 Facility / Infrastructure

These are non-staff items required to support data service provider operations.

1. External Net Connection.
2. Source / Service.
3. Bandwidth.
4. Recurring COTS Software License Cost.
5. Facility Area.
6. Data System Area.
7. Backup Archive Facility LOS.
8. Internal Support LOS.

3 Mapping of Reference Model Parameters to Requirements / Levels of Service

This section presents a mapping of the requirements / levels of service defined in Working Paper 5, "General DSP Reference Model - Requirements / Levels of Service" with the Data Service Provider Reference Model parameters defined in Section 2 above.

In this version, the mapping takes the form of simple tables, one for each functional area. Each table lists the requirements identified by their "WP-5 Requirement ID", the Working Paper 5 subsection number in which they appear, with the applicable parameters identified by their "Parameter ID", which is the abbreviated Section 2.2 subsection number in which they appear and their item number within the subsection (e.g. a parameter ID of 72-4 refers to section 2.2.7.2 item 4, "Help Desk Hours of Operation"; the intent is to make it easy to find the parameter definition). LOS in parentheses following the requirement ID indicates that levels of service were defined for the requirement, and LOS after the parameter ID indicates that it holds the LOS value. The parameters are for convenience grouped as "computed", i.e. internal parameters derived from inputs, or "input", i.e. parameters whose values would be specified by the user.

The cost estimation parameters in Section 2.2 are mapped to requirements in Working Paper 5 in order to ensure that the cost estimate is driven by real requirements. For example, assume that a data service provider will have to ingest a certain volume of data in order to meet its mission responsibilities. The volume of data it must ingest will affect its implementation and operation cost. Therefore in Working Paper 5 there will be a requirement that the data service provider shall ingest a certain volume (or that the data service provider shall ingest a list of data streams whose volume totals to a certain volume), and in Section 2.2 there will be a corresponding operational workload parameter, the volume of data to be ingested, that is needed for cost estimation.

The parameters that map most directly to the requirements will be included in the tables below, along with some computed 'roll-up' parameters (e.g. 'product types ingested/yr' is included as well as the parameter holding the list of types, 'ingest product type name'); other computed parameters, derived from listed parameters, will not be included. Because of the general nature of the requirements in Working Paper 5, there will often be a 'many to one' mapping of parameters to requirements.

Table 1 - Ingest Requirements/LOS vs Parameters

WP-5 Requirement ID	Parameter ID's and Notes
2.1 a (LOS)	Input: 12-1, 12-3, 12-5-LOS, 12-6, 12-7, 12-8, 12-9, 12-10 Computed: 11-5, 11-8, 11-9, 11-10, 11-13-LOS
2.1 b	TBD - metrics collection

Table 2 - Processing Requirements/LOS vs Parameters

WP-5 Requirement ID	Parameter ID's and Notes
2.2 a (LOS)	Input: 22-1, 22-4, 22-5, 22-6, 22-7, 22-8, 22-9, 22-12-LOS Computed: 21-5, 21-7, 21-9, 21-12, 21-14, 21-16, 21-18, 21-21-LOS
2.2 b (LOS)	Input: 22-1, 22-4, 22-6, 22-7, 22-8, 22-9, 22-14-LOS Computed: 21-6, 21-7, 21-9, 21-13, 21-14, 21-16, 21-18, 21-22-LOS
2.2 c (LOS)	Input: 22-1, 22-6, 22-7, 22-10-LOS Computed: 21-8, 21-9, 21-15, 21-16, 21-18, 21-23
2.2 d (LOS)	Input: 22-1, 22-6, 22-7, 22-11, 22-14-LOS Computed: 21-8, 21-9, 21-15, 21-16, 21-18
2.2 e (LOS)	Input: 22-2, 22-15-LOS Computed: 21-3
2.2 f	Input: 22-16 Computed: 21-3
2.2 g	TBD - metrics collection

Table 3 - Documentation Requirements/LOS vs Parameters

WP-5 Requirement ID	Parameter ID's and Notes
2.3 a (LOS)	Input: 32-1-LOS
2.3 b (LOS)	Input: 32-2-LOS
2.3 c	Input: 32-3

Table 4 - Archive Requirements/LOS vs Parameters

WP-5 Requirement ID	Parameter ID's and Notes
2.4 a	Input: 12-10, 22-9 Computed: 41-5, 41-8, 41-10, 41-13, 41-15
2.4 b	Input: 12-10 Computed: 41-5, 41-8, 41-10, 41-13, 41-15
2.4 c	Input: 12-10, 22-9, 42-8, 42-10-LOS, 42-11-LOS
2.4 d	None.
2.4 e (LOS)	Input: 42-5-LOS
2.4 f (LOS)	Input: 42-11-LOS
2.4 g (LOS)	Input: 42-10-LOS
2.4 h (LOS)	Input: 42-6-LOS, 42-7, 42-8-LOS Computed: 41-14, 41-15
2.4 i (LOS)	Input: 42-2-LOS
2.4 j (LOS)	Input: 42-9-LOS
2.4 k	TBD Metrics Collection

Table 5 - Search and Order Requirements/LOS vs Parameters

WP-5 Requirement ID	Parameter ID's and Notes
2.5 a (LOS)	Input: 52-1-LOS
2.5 b (LOS)	Input: 52-2-LOS
2.5 c (LOS)	Input: 52-4-LOS
2.5 d	Input: 52-5
2.5 e (LOS)	Input: 52-3-LOS

Table 6 - Access and Distribution Requirements/LOS vs Parameters

WP-5 Requirement ID	Parameter ID's and Notes
2.6 a (LOS)	Input: 62-2-LOS
2.6 b	Input: 62-8, 62-19 Computed: 61-9
2.6 c (LOS)	Input: 62-22-LOS
2.6 d	Input: 62-3
2.6 e	Input: 62-23-LOS
2.6 f (LOS)	Input: 62-9, 62-11, 62-16, 62-18, 62-23-LOS Computed: 61-20, 61-21
2.6 g (LOS)	Input: 62-10, 62-12, 62-15, 62-17, 62-24-LOS Computed: 61-22, 61-23
2.6 h	Input: 62-21 Computed: 61-24, 61-25
2.6 i	Input: 62-25 Computed: 61-26, 61-27
2.6 j	TBD - Metrics Collection

Table 7 - User Support Requirements/LOS vs Parameters

Requirement ID	Parameter ID's and Notes
2.7 a (LOS)	Input: 72-3-LOS
2.7 b (LOS)	Input: 72-1-LOS
2.7 c (LOS)	Input: 72-4-LOS
2.7 d	None.
2.7 e (LOS)	Input: 72-6-LOS

Table 8 - Instrument / Mission Operations Requirements/LOS vs Parameters

Requirement ID	Parameter ID's and Notes
2.8 a	Input: 82-1, 82-2, 82-4, 82-5
2.8 b	Input: 82-3

Table 9 - Sustaining Engineering Requirements/LOS vs Parameters

Requirement ID	Parameter ID's and Notes
2.9 a (LOS)	Input: 92-2-LOS Computed: 91-4

Table 10 - Engineering Support Requirements/LOS vs Parameters

Requirement ID	Parameter ID's and Notes
2.10 a (LOS)	Input: 102-1-LOS
2.10 b (LOS)	Input: 102-2-LOS

Table 11 - Technical Coordination Requirements/LOS vs Parameters

Requirement ID	Parameter ID's and Notes
2.11 a	Input: 112-1 Computed: 111-4
2.11 b	Input: 112-2 Computed: 111-5
2.11 c	Input: 112-3 Computed: 111-6
2.11 d	Input: 112-4 Computed: 111-7
2.11 e	Input: 112-5 Computed: 111-8
2.11 f	Input: 112-6 Computed: 111-9
2.11 g	Input: 112-7 Computed: 111-10
2.11 h	Input: 112-8 Computed: 111-11
2.11 i	Input: 112-9

Table 12 - Implementation Requirements/LOS vs Parameters

Requirement ID	Parameter ID's and Notes
2.12 a	None - system design
2.12 b	None - staffing plan
2.12 c	None - facility plan
2.12 d	Computed: 121-3, 121-5
2.12 e (LOS)	Input: 122-2
2.12 f	None - staff

Table 13 - Management Requirements/LOS vs Parameters

Requirement ID	Parameter ID's and Notes
2.13 a	Computed: 131-2, 131-3
2.13 b	Computed: 131-4
2.13 c	Computed: 131-5
2.13 d	Computed: 131-6
2.13 e	Computed: 131-7

Table 14 - Facility / Infrastructure Requirements/LOS vs Parameters

Requirement ID	Parameter ID's and Notes
2.14 a	Computed: 141-4
2.14 b	Input: 142-5, 142-6
2.14 c (LOS)	Input: 142-7-LOS
2.14 d (LOS)	Input: 142-8 Computed: 141-3
2.14 e	Input: 142-1, 142-2, 142-3

References and Acronym List

The References Section and the Acronym List for all of these Working Papers is in the document "References and Acronyms for the Levels of Service / Cost Estimation Working Papers ".